removing the second mask film from the bottom of the trenches without removing the second mask film on the side walls of the trenches, forming a side wall made of the second mask film on the side walls of the trenches;

and using the first mask film and the second mask film as the etching mask in etching said trenches deeper so as to form wiring-forming trenches on the insulating film, followed by burying an electroconductive material in the wiring-forming trenches to form a wiring layer made of the electroconductive material.

REMARKS

Reconsideration of the application in view of the above amendments and the following remarks is respectfully requested.

The examiner rejects Claims 1-11 under 35 U.S.C. 103(a) as being unpatentable over Tsuji in view of Harari. The examiner states that Tsuji teaches a method of manufacturing a semiconductor device having the features of the present invention except that Tsuji does not disclose the removal of the first and second mask films nor does he disclose the trenches have sidewalls. The examiner states that one can see by referring to anyone of Tsuji's Figures 4-8 that the trench form has sidewalls and further explicitly recites Harari as disclosing this feature.

We cannot agree. The independent Claims 1-3 of the present application do not merely recite that there are sidewalls to the trenches. The claims recite "...forming a sidewall made of the second mask film..." (emphasis added). It is clear from looking at all the figures in Tsuji that the mask films are only on the surface of the insulating film. Neither the first or second mask forms along the sidewalls of the trench that is formed. See, for example, element 41 in Figures 4A and 4B; elements 41 and 52 in Figures 5A and 5B; element 41 in Figure 6A and 6B and element 71 in Figure 7A. The examiner's statements to the contrary notwithstanding, it is clear to anyone skilled in the art by reviewing the drawings of Tsuji only that there is no sidewall formed in any of the steps shown in which a mask material is deposited on the sidewalls of the trench. Nor is there any showing or suggestion in the text that such sidewalls are, should be or could be present. Although Harari explicitly states the existence of sidewalls in the claims, as specified by the examiner, it does not recite sidewalls made of a mask material.

Claims 1-3 have been clarified in order that it be clear how the second mask material forms the film covering the sidewalls of the trenches, and thus clearly distinguishes over the references cited by the

examiner. The advantage of the present invention over the cited prior art is that the trenches can be made much more perpendicular than those of the prior art, which result in tapered trenches. Since the trench must be a certain width, the utilization of tapered trenches means that devices must be further apart at the surface in order that the narrowest portion of the trench meets the design specifications. Thus, use of perpendicular trenches allows the devices to be placed much more closely to each other, which results in more devices in the same amount of silicon or a reduction in the amount of silicon would require to produce the device, thus providing a substantial savings and improvements in the performance of the integrated circuit, as is well known to those skilled in the art.

Accordingly, applicants believe the application, as amended, is in condition for allowance, and such action is respectfully requested.

Respectfully submitted,

William B. Kempler
Senior Corporate Patent Counsel
Reg. No. 28,228

Texas Instruments Incorporated
P. O. Box 655474, M/S 3999
Dallas, TX 75265
(972) 917-5452
(972) 917-4407 FAX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (Three Times Amended) A manufacturing method of a semiconductor IC device, comprising the following steps :

forming an insulating film on a semiconductor substrate or SOI substrate;

forming a first mask film on the insulating film;

forming a resist film on the first mask film, the resist film being used as an etching mask to form an opening on the first mask film, followed by the formation of trenches on the insulating film exposed from the opening said trenches being made deeper than a thickness of said insulating film so as to penetrate into a portion of said substrate;

forming, after the resist film is removed, a second mask film on the semiconductor substrate or SOI substrate, said second mask film covering side walls and a bottom of the trenches;

removing the second mask film from the bottom of the trenches without removing the second mask film on the side walls of the trenches, forming a side wall made of the second mask film on the side walls of the trenches;

and using the first mask film and the [side wall] second mask film as the etching mask in etching [off the insulating film exposed from the mask,] said trenches deeper so as to form connecting holes [on the insulating film].

2. (Three Times Amended) A manufacturing method of a semiconductor IC device comprising the following steps :

forming an insulating film on a semiconductor substrate or SOI substrate;

forming a first mask film on the insulating film;

forming a resist film on the first mask film, the resist film being used as an etching mask to form an opening on the first mask film, followed by the formation of trenches on the insulating film exposed from the opening said trenches being made deeper than a thickness of said insulating film so as to penetrate into a portion of said substrate;

forming , after the resist film is removed, a second mask film on the semiconductor substrate or SOI substrate, said second mask film covering side walls and a bottom of the trenches;

removing the second mask film from the bottom of the trenches without removing the second mask film on the side walls of the trenches, forming a side wall made of the second mask film on the side walls of the trenches;

using the first mask film and the [side wall] second mask film as the etching mask in etching [off the insulating film exposed from the mask,] etching said trenches deeper so as to form an opening on the insulating film, followed by the formation of separating trenches on the semiconductor substrate or SOI substrate exposed from the opening;

burying an insulating film in the separating trenches to form a separating portion.

3. (Three Times Amended) A manufacturing method of a semiconductor IC device comprising the following steps :

forming an insulating film on a semiconductor substrate or SOI substrate;

forming a first mask film on the insulating film;

forming a resist film on the first mask film, the resist film being used as an etching mask to form an opening on the first mask film, followed by the formation of trenches on the insulating film exposed from the opening said trenches being made deeper than a thickness of said insulating film so as to penetrate into a portion of said substrate;

forming, after the resist film is removed, a second mask film on the semiconductor substrate or SOI substrate, said second mask film covering side walls and a bottom of the trenches;

removing the second mask film from the bottom of the trenches without removing the second mask film on the side walls of the trenches, forming a side wall made of the second mask film on the side walls of the trenches;

and using the first mask film and the [side wall] second mask film as the etching mask in etching [off the insulating film exposed from the mask,] said trenches deeper so as to form wiring-forming trenches on the insulating film, followed by burying an electroconductive material in the wiring-forming trenches to form a wiring layer made of the electroconductive material.